SWR-99-SA-076

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

In Reply Refer To:
APR 16 2001 SWR-F-SA-003:MEA

Mr. Frank Michny
Bureau of Reclamation
2800 Cottage Way
Sacramento, California 95825-1898

Dear Mr. Michny:

Enclosed is a final biological opinion prepared by the National Marine Fisheries Service (NMFS) for the proposed 12 year Vernalis Adaptive Management Plan (VAMP) fishery sampling in the lower San Joaquin River near Jersey Point, beginning on April 15, 2000 and concluding on June 1, 2011, and its effects on federally endangered Sacramento River winter-run chinook salmon (*Oncorhynchus tshawytscha*), threatened Central Valley spring-run chinook salmon (*Oncorhynchus tshawytscha*), and threatened Central Valley steelhead (*Oncorhynchus mykiss*) pursuant to Section 7 of the Endangered Species Act of 1973, as amended (Act). This biological opinion was based on information provided in several discussions with Mr. Dave Robinson and Dr. Chuck Hansen, Hansen Environmental Inc., a plan of study provided by Dr. Hansen, dated January 11, 2000, and a recalculation of anticipated incidental take provided to the NMFS on January 31, 2001.

Based on the best available scientific information, this biological opinion concludes that the proposed fishery sampling program is not likely to jeopardize the continued existence of Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, or Central Valley steelhead, or result in the destruction or adverse modification of designated critical habitat for these species. An incidental take statement with reasonable and prudent measures designed to minimize incidental take has been prepared and is included in the biological opinion. The incidental take statement anticipates the incidental take of Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, and Central Valley steelhead during the course of the VAMP fishery sampling activities between April 15, 2000 and June 1, 2011, as described in this biological opinion.

Consultation must be reinitiated if (1) the amount or extent of incidental take specified in the incidental take statement is exceeded; (2) new information reveals that the VAMP fishery sampling program may affect winter-run chinook salmon, spring-run chinook salmon, or steelhead in a manner or to an extent not previously considered; (3) the action is subsequently modified in a manner that causes an effect to the listed species that was not considered in the biological opinion; or (4) a new species is listed, or critical habitat is designated that may be affected by the study programs.

If you have questions concerning this opinion, or need further assistance, please contact Mr. Michael Aceituno in our Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, California 95814. Mr. Aceituno can be reached by telephone at (916) 930-3600 or by FAX at (916)930-3629.

Sincerely,

James D. Lecky

Rebecca Lent, Ph.D.
Regional Administrator

Enclosure

cc: Charles H. Hansen, Ph.D., Hanson Environmental, Inc., Walnut Creek, CA

BIOLOGICAL OPINION

Agency: Mid-Pacific Region, Bureau of Reclamation

Activity: Vernalis Adaptive Management Plan (VAMP) Fishery Sampling in the Lower San Joaquin River near Jersey Point

Consultation Conducted By: Southwest Region, National Marine Fisheries Service.

Date Issued: APR 16 2001

I. BACKGROUND AND CONSULTATION HISTORY

Informal consultation regarding the Vernalis Adaptive Management Plan (VAMP) fishery sampling study has been ongoing between the National Marine Fisheries Service (NMFS), the U.S. Bureau of Reclamation (Bureau) and Dr. Charles H. Hanson (Senior Biologist/Principle, Hanson Environmental, Inc.). Dr. Hanson will be conducting the VAMP fishery sampling on behalf of the Bureau. On March 2, 2000, the Bureau requested consultation pursuant to Section 7 of the Endangered Species Act (ESA) for Vernalis Adaptive Management Plan (VAMP) fishery sampling activities.

Materials and information relative to the VAMP fish sampling program have been provided to NMFS in various formats. This biological opinion is primarily based on information provided in by Dr. Hanson, dated January 11, 2000, and the document entitled "Vernalis Adaptive Management Plan (VAMP) 2000 Salmon Smolt Survival Investigation Study Plan." Additional information and clarification was provided at a meeting with Mr. Dave Robinson, Bureau of Reclamation, and Dr. Hanson on April 5, 2000 and by e-mail from Dr. Hanson on April 11, 2000. A recalculation of salmonid incidental take associated with the VAMP fishery sampling was submitted to NMFS on January 31, 2001. A complete administrative record of this consultation is on file with the NMFS Sacramento Area Office, Sacramento, California.

II. DESCRIPTION OF PROPOSED ACTION

The Bureau proposes to fund Dr. Charles H. Hanson (Hanson Environmental, Inc.) to perform the studies outlined under the VAMP fishery sampling program.

The VAMP has been developed to provide (1) protection for juvenile chinook salmon emigrating from the San Joaquin River through the Sacramento-San Joaquin Delta, and (2) an experimental determination of juvenile chinook salmon survival in response to San Joaquin River flow and Central Valley Project (CVP) and State Water Project (SWP) exports. San Joaquin River flows and CVP/SWP exports are commonly believed to affect survival of juvenile fall-run Chinook

salmon emigrating from the San Joaquin River basin. The VAMP experimental investigation and sampling program has been designed to:

- Serve as the implementation program for the State Water Resources Control Board (SWRCB) 1995 Water Quality Control Plan providing fisheries protection for the lower San Joaquin River;

- Facilitate implementation of elements of the Central Valley Project Improvement Act (CVPIA) Anadromous Fish Restoration Program (AFRP) Delta actions for the lower San Joaquin River;

- Provide data on the occurrence and density of sensitive fish species in the lower San Joaquin River adjacent to Jersey Point as part of the real-time monitoring program for use as technical input in evaluating real-time operations of the CVP and SWP facilities;

- Implement interim salmon protective measures within a carefully designed experimental structure which will satisfy the need for immediate protection;

- Provide the scientific information to reduce biological uncertainty regarding the effects of San Joaquin River flow, and CVP/SWP export upon salmon smolt emigration success; and,

- Permit greater efficiency and confidence in future decisions regarding conservation of San Joaquin River chinook salmon stocks.

The VAMP program employs an adaptive management strategy to use current knowledge of hydrology and environmental conditions to protect Chinook salmon smolt passage, while gathering information to allow more efficient protection in the future.

The design of the VAMP fishery sampling program is based in large part on experience gained in earlier fisheries investigations conducted by the California Department of Fish and Game and the U.S. Fish and Wildlife Service. These investigations provide insight into factors affecting juvenile chinook salmon survival and on opportunities for providing increased fisheries protection during the spring salmon smolt emigration period.

Fisheries sampling has been designed to recapture coded-wire tag marked fall-run chinook salmon smolts released at various locations within the lower San Joaquin River system for use in estimating salmon smolt survival as a function of San Joaquin River flow (measured at Vernalis) and CVP/SWP export rates. The salmon smolt survival investigations are scheduled to occur during the spring of each year (April 15 - June 1) over a 12-year period, beginning on April 15, 2000 and ending on June 1, 2011. The VAMP sampling effort will be conducted in the vicinity of Jersey Point in the lower San Joaquin River. Information obtained through previous sampling programs has been used to evaluate the performance of the Jersey Point sampling for use in estimating salmon smolt survival, and serves as the technical basis for estimating potential incidental take of Sacramento River winter-run chinook salmon, Central Valley spring-run

chinook salmon, and Central Valley steelhead as a result of future sampling activity. In addition, this information was used in evaluating and refining modifications to the sampling protocol designed to avoid and minimize incidental take of these protected species.

Chinook salmon collected during the VAMP fishery sampling program will be identified as fall-run, spring-run, winter-run, and late fall-run races based on the daily size criteria used in fisheries monitoring at the State Water Project (SWP) fish salvage facility and the U.S. Fish and Wildlife Service (USFWS) delta fisheries monitoring program.

Basic elements of the Jersey Point sampling program are briefly described below:

Fishery Sampling

Fishery sampling as part of VAMP will be conducted in the vicinity of Jersey Point on the lower San Joaquin River using a Kodiak trawl. A Kodiak trawl has a graded stretch mesh, from 2-inch mesh at the mouth to ¼-inch mesh at the cod-end. Its overall length is 65 feet, and the mouth opening is 6 feet deep and 25 feet wide. A General Oceanics flow meter will be used to estimate the volume of water sampled during each collection, for use in calculating catch-per-unit-of-effort (CPUE). The net is towed between two skiffs, operating at an engine speed of approximately 2,000 RPM. Trawl duration is approximately 20 minutes, sampling in an upstream direction. Trawls in the lower San Joaquin River at Jersey Point will be performed parallel to the left bank, mid-channel, and right bank to sample coded-wire tagged salmon emigrating from the San Joaquin River.

Sampling Location

Sampling will be conducted within an area of the lower San Joaquin River immediately upstream of Jersey Point, and downstream of the confluence between the San Joaquin River and Three-Mile Slough.

Seasonal Timing

The sampling period will be between April 15 and June 1 each year. Sampling will be conducted between 5 am and 10 pm daily during the sampling period.

Level of Effort

Based upon results of previous sampling efforts, up to approximately 36 20-minute Kodiak trawl collections will be completed per day. The maximum level of sampling effort anticipated would be 36 tows per day over the 47-day sampling period, resulting in 1,692 collections per year. Assuming that each sample would be 20 minutes in duration, the maximum anticipated collection effort would be 33,840 minutes per year.

Sample Processing

All fish collected will be transferred immediately from the Kodiak trawl to buckets filled with river water, where the fish are held during processing. Data collected during each trawl includes enumeration and fork length of fish collected, and water volume sampled. Mortality and damage to fish collected will also be documented. Catch-per-unit-of-effort (CPUE) will be calculated as the number of each species per minute, and the number per 1,000 m^3 of water sampled during each collection.

No steelhead or chinook salmon will be intentionally killed which are not coded-wire tagged (as evidenced by an adipose fin clip) nor will tissue or scale samples be collected from unmarked chinook salmon or steelhead collected during Kodiak trawls performed as part of the VAMP investigations.

Upon request by NMFS, dead specimens in good condition will be held on ice until they can be either frozen or preserved. These fish will be available for genetic analyses, histological examination, or other relevant scientific purposes. Tissue samples from these specimens will be shared, upon request, with investigators from DFG, NMFS, FWS, academia, or for use in any other qualified programs.

Release

Chinook salmon which have not been coded-wire tagged and marked with an adipose fin clip, and steelhead will be released after collection at a location downstream of the sampling site immediately after enumeration and measurement. No fish will be transported more than ¼ mile from the sampling site. Field personnel will visually monitor and record the condition of each fish (e.g., healthy and vigorous, lethargic, loss of equilibrium, dead) immediately before release.

Reporting

Fisheries data collected from the VAMP sampling program will be compiled each year in a technical report. The annual VAMP report and accompanying electronic database will be made available to any interested party for further analysis of the population distribution and dynamics of these species over a wide range of Sacramento – San Joaquin Delta hydrologic conditions, water quality conditions, and CVP/SWP export operations during the 12-year period of the VAMP experimental investigations. The resulting information from the VAMP sampling program represents a significant source of scientific data, which directly compliments information collected from other fisheries monitoring programs being conducted within the Sacramento – San Joaquin Delta.

Data collected and analyzed as part of the VAMP annual report will document avoidance and minimization measures implemented as part of the sampling program. The annual report will analyze data for protected species to evaluate the potential benefits of various actions for reducing incidental take with specific recommendations for avoidance and minimization

measures to be incorporated into subsequent sampling conducted as part of the VAMP investigations.

III. LISTED SPECIES AND CRITICAL HABITAT

This biological opinion analyzes the effects of the described VAMP fishery sampling activities on the following Federally listed species and their designated critical habitats: (1) threatened Central Valley spring-run chinook salmon (*Oncorhynchus tshawytscha*); (2) endangered Sacramento River winter-run chinook salmon(*Oncorhynchus tshawytscha*); and, (3) threatened Central Valley steelhead (*Oncorhynchus mykiss*). These species may be incidentally captured during VAMP fishery sampling.

Central Valley Spring-run Chinook Salmon - Threatened: Population Trends, Life History, and Biological Requirements

Effective November 16, 1999, NMFS listed Central Valley spring-run chinook salmon as threatened under the Endangered Species Act (64 FR 50394). Historically, spring-run chinook salmon were predominant throughout the Central Valley, occupying the upper and middle reaches of the San Joaquin, American, Yuba, Feather, Sacramento, McCloud, and Pit Rivers, with smaller populations in most other tributaries with sufficient habitat for over-summering adults (Stone 1874, Rutter 1904, Clark 1929). The Central Valley drainage as a whole is estimated to have supported spring-run chinook salmon runs as large as 600,000 fish between the late 1880s and 1940s (DFG 1998). Before the construction of Friant Dam, nearly 50,000 adults were counted in the San Joaquin River (Fry 1961). Following the completion of Friant Dam, the native population from the San Joaquin River and its tributaries was extirpated. Also, spring-run no longer exist in the American River due to Folsom Dam.

Impassable dams block access to most of the historical headwater spawning and rearing habitat of Central Valley spring-run chinook salmon. In addition, much of the remaining, accessible spawning and rearing habitat is severely degraded by elevated water temperatures, agricultural and municipal water diversions, unscreened and poorly screen water intakes, restricted and regulated stream flows, levee and bank stabilization, and poor quality and quantity of riparian and shaded riverine aquatic (SRA) cover.

Natural spawning populations of Central Valley spring-run chinook salmon are currently restricted to accessible reaches in the upper Sacramento River, Antelope Creek, Battle Creek, Beegum Creek, Big Chico Creek, Butte Creek, Clear Creek, Deer Creek, Feather River, Mill Creek, and Yuba River (DFG 1998; USFWS, unpublished data). With the exception of Butte Creek and the Feather River, these populations are relatively small ranging from a few fish to several hundred. Butte Creek returns in 1998 and 1999 numbered approximately 20,000 and 3,600, respectively (DFG unpublished data).

Spring-run chinook salmon adults are estimated to leave the ocean and enter the Sacramento River from March to July (Myers et al. 1998). When they enter freshwater, spring-run chinook salmon

are immature and they must stage for several months before spawning. Their gonads mature during their summer holding period in freshwater. Over-summering adults require cold-water refuges such as deep pools to conserve energy for gamete production, redd construction, spawning, and redd guarding.

Spawning typically occurs between late-August and early October with a peak in September. Once spawning is completed, adult spring-run chinook salmon die. Spawning typically occurs in gravel beds that are located at the tails of holding pools (USFWS 1995a). Eggs are deposited within the gravel where incubation, hatching, and subsequent emergence takes place.

Length of time required for eggs to develop and hatch is dependant on water temperature and is quite variable, however, hatching generally occurs within 40 to 60 days of fertilization (Vogel and Marine 1991). In Deer and Mill creeks, embryos hatch following a 3-5 month incubation period (USFWS 1995).

After hatching, pre-emergent fry remain in the gravel living on yolk-sac reserves for another two to four weeks until emergence. Timing of emergence within different drainages is strongly influenced by water temperature. Emergence of spring-run chinook typically occurs from November through January in Butte and Big Chico Creeks and from January through March in Mill and Deer Creeks (DFG 1998).

Post-emergent fry seek out shallow, near shore areas with slow current and good cover, and begin feeding on small terrestrial and aquatic insects and aquatic crustaceans. As they grow to 50 to 75 mm in length, the juvenile salmon move out into deeper, swifter water, but continue to use available cover.

In Deer and Mill creeks, juvenile spring-run chinook, during most years, spend 9-10 months in the streams, although some may spend as long as 18 months in freshwater. Most of these "yearling" spring-run chinook move downstream in the first high flows of the winter from November through January (USFWS 1995, DFG 1998). In Butte and Big Chico creeks, spring-run chinook juveniles typically exit their natal tributaries soon after emergence during December and January, while some remain throughout the summer and exit the following fall as yearlings. In the Sacramento River and other tributaries, juveniles may begin migrating downstream almost immediately following emergence from the gravel with emigration occurring from December through March (Moyle, et al. 1989, Vogel and Marine 1991). Fry and parr may spend time rearing within riverine and/or estuarine habitats including natal tributaries, the Sacramento River, non-natal tributaries to the Sacramento River, and the Sacramento-San Joaquin Delta. In general, emigrating juveniles that are younger (smaller) reside longer in estuaries such as the Delta (Kjelson et al. 1982, Levy and Northcote 1982, Healey 1991). The brackish water areas in estuaries moderate the physiological stress that occurs during parr-smolt transitions. Although fry and fingerlings can enter the Delta as early as January and as late as June, their length of residency within the Delta is unknown but probably lessens as the season progresses into the late spring months (DFG 1998).

In preparation for their entry into a saline environment, juvenile salmon undergo physiological transformations known as smoltification that adapt them for their transition to salt water (Hoar 1976). These transformations include different swimming behavior and proficiency, lower swimming stamina, and increased buoyancy that also make the fish more likely to be passively transported by currents (Saunders 1965, Folmar and Dickhoff 1980, Smith 1982). In general, smoltification is timed to be completed as fish are near the fresh water to salt water transition. Too long a migration delay after the process begins is believed to cause the fish to miss the "biological window" of optimal physiological condition for the transition (Walters et al. 1978).

Chinook salmon spend between one and four years in the ocean before returning to their natal streams to spawn (Myers et al. 1998). Fisher (1994) reported that 87% of returning spring-run adults are three-years-old based on observations of adult chinook trapped and examined at Red Bluff Diversion Dam between 1985 and 1991.

Central Valley Spring-run Chinook Salmon Critical Habitat

On February 16, 2000 NMFS designated critical habitat for the Central Valley spring-run chinook salmon Evolutionarily Significant Unit (ESU)(65 FR 7764). Critical habitat consists of the water, substrate, and adjacent riparian zone of accessible estuarine and riverine reaches. Accessible reaches are those within the historical range of the Central Valley spring-run chinook ESU that can still be occupied by any life stage of chinook salmon. Inaccessible reaches are those above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years) and specific dams within the historical range of each ESU.

Critical habitat for Central Valley spring-run chinook is designated to include all river reaches accessible to chinook salmon in the Sacramento River and its tributaries in California. Also included are river reaches and estuarine areas of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Excluded are areas above specific dams or above longstanding naturally impassable barriers.

Sacramento River Winter-run Chinook Salmon - Endangered: Population Trends, Life History, and Biological Requirements.

The Sacramento River winter-run chinook salmon (*Oncorhynchus tshawytscha*) is one of four distinct runs of chinook salmon in the Sacramento River and was listed as endangered by NMFS on January 4, 1994 (59 FR 440). Adult winter-run chinook salmon run sizes took a dramatic decline between 1967 and 1980, from an estimated high of 108,855 in 1969 to a low of 84 in 1980. Since 1981 the adult population has stabilized somewhat but has remained at a low level with an average estimated run size of 1,899 adults. The estimated adult winter-run chinook salmon run size for 1999 was 885 adults (DFG 2000).

Adult winter-run chinook salmon generally leave the ocean and migrate through the Sacramento-San Joaquin Delta to the upper Sacramento River from December through June. The majority of winter-run chinook salmon spawning occurs upstream of Red Bluff Diversion Dam; however, some spawners utilize gravel below the dam. The spawning phase of winter-run chinook salmon primarily occurs from May through July. The eggs are fertilized and buried in the river gravel (redds) where they incubate for approximately two-months.

Emergence of winter-run fry from the gravel begins in early July and continues through September. Juveniles redistribute themselves and rear in the Sacramento River from July through April. The peak emigration of winter-run juveniles through the Sacramento-San Joaquin Delta generally occurs from January through April, but the range of emigration may extend from September through June (Schaffer 1980, Messersmith 1966, California Department of Fish and Game(DFG) 1993, U.S. Fish and Wildlife Service(USFWS) 1992, USFWS 1993, USFWS 1994). Low to moderate numbers may occur as early as October or November, or later in May, depending on water year type, precipitation and accretion to the Sacramento River, and river flows. Distinct emigration pulses appear to coincide with high precipitation and increased turbidity (Hood 1990). Juvenile chinook salmon of winter-run size have also been collected in Montezuma Slough in November, following early fall storms in October (Pickard et al. 1982).

Sacramento River winter-run Chinook Salmon Critical Habitat.

On June 16, 1993, NMFS designated critical habitat for the winter-run chinook salmon (58 FR 33212). Critical habitat for the winter-run chinook salmon includes the Sacramento River from Keswick Dam (RM 302) to Chipps Island (RM 0) at the westward margin of the Sacramento-San Joaquin Delta; all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge.

Within the Sacramento River, critical habitat includes the river water, river bottom (including those areas and associated gravel used by winter-run chinook salmon as a spawning substrate), and the adjacent riparian zone used by fry and juveniles for rearing. In areas westward from Chipps Island, including San Francisco Bay to the Golden Gate Bridge, it includes the estuarine water column, essential foraging habitat, and food resources used by the winter-run chinook salmon as part of their juvenile out migration or adult spawning migration.

Central Valley Steelhead - Threatened: Population Trends, Life History, and Biological Requirements

On March 19, 1998 NMFS listed Central Valley steelhead as threatened under the Endangered Species Act (63 FR 13347). Central Valley steelhead once ranged throughout most of the tributaries and headwaters of the Sacramento and San Joaquin basins prior to dam construction, water development, and watershed disturbance of the 19th and 20th centuries (McEwan and Jackson 1996). Historical documentation exists that show steelhead were once widespread throughout the San Joaquin River system (CALFED 1999). In the early 1960s, the California

Fish and Wildlife Plan estimated a total run size of about 40,000 adults for the entire Central Valley including San Francisco Bay (DFG 1965). The annual run size for Central Valley steelhead in 1991-92 was probably less than 10,000 fish based on dam counts, hatchery returns and past spawning surveys (McEwan and Jackson 1996).

Estimates of steelhead historical habitat can be based on estimates of salmon historical habitat. The extent of habitat loss for steelhead is probably greater than losses for salmon, because steelhead go higher into the drainages than do chinook salmon (Yoshiyama et al. 1996). Clark (1929) estimated that originally there were 6,000 miles of salmon habitat in the Central Valley system and that 80% of this habitat had been lost by 1928. Yoshiyama et al. (1996) calculated that roughly 2,000 miles of salmon habitat was actually available before dam construction and mining, and concluded that 82% of what was present is not accessible today. Clark (1929) did not give details about his calculation. Whether Clark's or Yoshiyama's calculation is used, only remnants of the former steelhead range remain accessible today in the Central Valley.

As with Central Valley spring-run chinook, impassable dams block access to most of the historical headwater spawning and rearing habitat of Central Valley steelhead. In addition, much of the remaining, accessible spawning and rearing habitat is severely degraded by elevated water temperatures, agricultural and municipal water diversions, unscreened and poorly screen water intakes, restricted and regulated stream flows, levee and bank stabilization, and poor quality and quantity of riparian and SRA cover.

At present, wild steelhead stocks appear to be mostly confined to upper Sacramento River tributaries such as Antelope, Deer, and Mill creeks and the Yuba River (McEwan and Jackson 1996). Naturally spawning populations are also known to occur in Butte Creek, and the upper Sacramento, Feather, American, Mokelumne, and Stanislaus Rivers (CALFED 1999). However, the presence of naturally spawning populations appears to correlate well with the presence of fisheries monitoring programs, and recent implementation of new monitoring efforts has found steelhead in streams previously thought not to contain a population, such as Auburn Ravine, Dry Creek, and the Stanislaus River. It is possible that other naturally spawning populations exist in Central Valley streams, but are undetected due to lack of monitoring or research programs (IEP Steelhead Project Work Team 1999).

All Central Valley steelhead are currently considered winter-run steelhead (McEwan and Jackson 1996), although there are indications that summer steelhead were present in the Sacramento River system prior to the commencement of large-scale dam construction in the 1940's (IEP Steelhead Project Work Team 1999). Adult steelhead migrate upstream in the Sacramento River mainstem from July through March, with peaks in September and February (Bailey 1954; Hallock et al. 1961). The timing of upstream migration is generally correlated with higher flow events, such as freshets or sand bar breaches, and associated lower water temperatures. The preferred temperatures for upstream migration are between 46° F and 52° F (Reiser and Bjornn 1979, Bovee 1978, Bell 1986).

Spawning may begin as early as late December and can extend into April with peaks from January through March (Hallock et al. 1961). Unlike chinook salmon, not all steelhead die after

spawning. Some may return to the ocean and repeat the spawning cycle for two or three years; however, the percentage of repeat spawners is generally low (Busby et al. 1996). Steelhead spawn in cool, clear streams featuring suitable gravel size, depth, and current velocity. Intermittent streams may be used for spawning (Barnhart 1986; Everest 1973).

Length of time required for eggs to develop and hatch is dependant on water temperature and is quite variable; hatching varies from about 19 days at an average temperature of 60° F to about 80 days at an average of 42° F. The optimum temperature range for steelhead egg incubation is 46° F to 52° F (Reiser and Bjornn 1979, Bovee 1978, Bell 1986, Leidy and Li 1987). Egg mortality may begin at temperatures above 56° F (McEwan and Jackson 1996).

After hatching, pre-emergent fry remain in the gravel living on yolk-sac reserves for another four to six weeks, but factors such as redd depth, gravel size, siltation, and temperature can speed or retard this time (Shapovalov and Taft 1954). Upon emergence, steelhead fry typically inhabit shallow water along perennial stream banks. Older fry establish territories which they defend. Stream side vegetation is essential for foraging, cover, and general habitat diversity. Steelhead juveniles are usually associated with the bottom of the stream. In winter, they become inactive and hide in available cover, including gravel or woody debris.

The majority of steelhead in their first year of life occupy riffles, although some larger fish inhabit pools or deeper runs. Juvenile steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles. Water temperatures influence the growth rate, population density, swimming ability, ability to capture and metabolize food, and ability to withstand disease of these rearing juveniles. Rearing steelhead juveniles prefer water temperatures of 45° F to 60° F (Reiser and Bjornn 1979, Bovee 1978, Bell 1986). Temperatures above 60° F have been determined to induce varying degrees of chronic stress and associated physiological responses in juvenile steelhead (Leidy and Li 1987).

After spending one to three years in freshwater, juvenile steelhead migrate downstream to the ocean. Most Central Valley steelhead migrate to the ocean after spending two years in freshwater (Hallock et al. 1961, Hallock 1989). Barnhart (1986) reported that steelhead smolts in California range in size from 14 to 21 cm (fork length). In preparation for their entry into a saline environment, juvenile steelhead undergo physiological transformations known as smoltification that adapt them for their transition to salt water. These transformations include different swimming behavior and proficiency, lower swimming stamina, and increased buoyancy that also make the fish more likely to be passively transported by currents (Saunders 1965, Folmar and Dickhoff 1980, Smith 1982). In general, smoltification is timed to be completed as fish are near the fresh water to salt water transition. Too long a migration delay after the process begins is believed to cause the fish to miss the "biological window" of optimal physiological condition for the transition (Walters et al. 1978). The optimal thermal range during smoltification and seaward migration for steelhead is 44° F to 52° F (Leidy and Li 1987, Rich 1997) and temperatures above 55.4° F have been observed to inhibit formation and decrease activity of gill (Na and K) ATPase activity in steelhead, with concomitant reductions in migratory behavior and seawater survival (Zaugg and Wagner 1973, Adams et. al 1975). Hallock et al. (1961) found that juvenile

steelhead in the Sacramento Basin migrated downstream during most months of the year, but the peak period of emigration occurred in the spring, with a much smaller peak in the fall.

Steelhead spend between one and four years in the ocean (usually one to two years in the Central Valley) before returning to their natal streams to spawn (Barnhart 1986, Busby et al. 1996).

Central Valley Steelhead Critical Habitat

On February 16, 2000 NMFS designated critical habitat for the Central Valley steelhead ESU (65 FR 7764). Critical habitat consists of the water, substrate, and adjacent riparian zone of accessible estuarine and riverine reaches. Accessible reaches are those within the historical range of the ESU that can still be occupied by any life stage of steelhead. Inaccessible reaches are those above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years) and specific dams within the historical range of each ESU.

Critical habitat for Central Valley steelhead is designated to include all river reaches accessible to listed steelhead in the Sacramento and San Joaquin Rivers and their tributaries in California. Also included are river reaches and estuarine areas of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Excluded are areas of the San Joaquin River upstream of the Merced River confluence and areas above specific dams or above longstanding naturally impassable barriers.

IV. ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat, and ecosystem within the action area (USFWS and NMFS 1998). The action area for this consultation is the lower San Joaquin River, between Jersey Point and Three-Mile Slough, approximately 8.5 to 13.0 river miles upstream of its confluence with the Sacramento River.

A. Status of the Listed and Proposed Species and Critical Habitat in the Action Area

Sacramento River winter-run chinook salmon. Historically, the Sacramento-San Joaquin Delta has been used by Sacramento River winter-run chinook salmon as a migration route to and from spawning areas. Adult, fry and juvenile winter-run chinook salmon may still be found seasonally within the action area.

Adult winter-run enter the San Francisco Bay from November through June (Van Woert 1958, Hallock et al. 1957). They migrate through the Sacramento-San Joaquin Delta and up the Sacramento River from December through early August. Run timing through the Delta typically occurs from December through April.

Fry emergence occurs from mid-June through mid-October. Emigration of juvenile winter-run chinook salmon from the Upper Sacramento River is highly dependent on streamflow conditions and water type. The peak emigration of winter-run chinook juvenile through the Delta generally occurs from January through April, but the range of emigration may extend from September up to June (Schaffer 1980, Messersmith 1966, California Department of Fish and Game 1989, California Department of Fish and Game Memo 1993, U.S. Fish and Wildlife Service 1992, U.S. Fish and Wildlife Service 1993, U.S. Fish and Wildlife Service 1994).

The Sacramento River winter-run chinook salmon population has generally shown a continuing population decline, an overall low population abundance, and fluctuating return rates. These demographics for Sacramento River winter-run chinook indicate the long-term viability of the ESU remains at risk.

The action area is not within the geographic extent of designated critical habitat for Sacramento River winter-run chinook salmon.

Central Valley spring-run chinook salmon. Historically, the Sacramento-San Joaquin Delta was used by Central Valley spring-run chinook salmon as a migration route to and from cooler tributary streams.

All of the emigrating juvenile sub-yearling and yearling Central Valley spring-run chinook use the Sacramento-San Joaquin River Delta as a migration corridor to the ocean. Some juveniles utilize tidal and non-tidal freshwater marshes and other shallow water areas in the Delta as rearing areas for short periods prior to the final portion of their emigration to the sea. All adult spring-run chinook salmon use the Delta as an upstream migration corridor to return to their natal streams for spawning.

Central Valley spring-run chinook populations generally show a continuing population decline, an overall low population abundance, and fluctuating return rates. These demographics for Central Valley spring-run chinook indicate the long-term viability of the ESU is at risk.

The action area is located within designated critical habitat of Central Valley spring-run chinook. Designated critical habitat within the action area ranges from riverine habitat to estuarine areas. The essential elements of critical habitat in these areas are the water, substrate, and adjacent riparian areas.

Central Valley steelhead. Central Valley steelhead populations within the action area generally show a continuing population decline, an overall low population abundance, and fluctuating return rates. Historical abundance estimates are available for some stocks within the action area but no overall reliable estimates are available.

All emigrating juvenile Central Valley steelhead smolts use the lower reaches of the Sacramento and San Joaquin Rivers and the Delta for rearing and as a migration corridor to the ocean. Some juveniles may utilize tidal and non-tidal freshwater marshes and other shallow water areas in the Delta as rearing areas for short periods prior to the final portion of their emigration to the sea.

All adult steelhead use the Delta and lower reaches of the Sacramento and San Joaquin rivers as an upstream migration corridor to return to their natal streams for spawning.

The action area is located within the designated critical habitat of the Central Valley steelhead. Designated critical habitat within the action area ranges from riverine habitat to estuarine areas. The essential elements of critical habitat in these areas are the water, substrate, and adjacent riparian areas.

B. Factors Affecting Species Environment within the Action Area

The essential features of freshwater and estuarine salmonid habitat include adequate (1) substrate; (2) water quality; (3) water quantity; (4) water temperature; (5) water velocity; (6) cover/shelter; (7) food; (8) riparian vegetation; (9) space; and (10) safe passage conditions. These features have been affected by human activities such as water management, flood control, agriculture, and urban development throughout the action area. Impacts to these features have led to salmonid population declines significant enough to warrant the listing of several salmonid species in the Central Valley of California.

High water quality and quantity are essential for survival, growth, reproduction, and migration of individuals dependent on riparian and aquatic habitats. Important water quality elements include flows adequate to support the migratory, rearing, and emergence needs of fish and other aquatic organisms. Desired flow conditions for salmonids include an annual abundance of cool, well-oxygenated water with low levels of suspended and deposited sediments or other pollutants that could limit primary production and/or invertebrate abundance and diversity.

Habitat Impacts in the Sacramento-San Joaquin Delta. The Sacramento River Basin provides approximately 75 percent of the water flowing into the Delta while the San Joaquin River Basin and eastside tributaries provide the remainder (DWR 1993). With the completion of upstream reservoir storage projects throughout the Central Valley, the seasonal distribution of flows into the Delta differs substantially from historical patterns. The magnitude and duration of peak flows during the winter and spring are reduced by water impoundment in upstream reservoirs. Instream flows during the summer and early fall months have increased over historic levels for deliveries of municipal and agricultural water supplies. Overall, water management now reduces natural variability by creating more uniform flows year-round.

Juvenile salmonids migrate downstream from their upper river spawning and nursery grounds to lower river reaches and the Delta prior to entering the ocean as smolts. To a great extent, streamflow volume and runoff patterns regulate the quality and quantity of habitat available to juvenile salmonids. Salmon and steelhead are highly adapted to seasonal changes in flow. Increased stream flows in the fall and winter stimulate juvenile salmonid downstream migration, improve rearing habitat, and improve smolt survival to the ocean. Changes in runoff patterns from upstream reservoir storage to the Delta have adversely affected Central Valley salmonids, including winter-run chinook salmon, spring-run chinook salmon and steelhead, through reduced survival of juvenile fish.

Historically, the tidal marshes of the Delta provided a highly productive estuarine environment for juvenile salmonids. During the course of their downstream migration, juvenile salmon and steelhead utilize the Delta's estuarine habitat for seasonal rearing, and as a migration corridor to the sea. Since the 1850's, reclamation of Delta islands for agricultural purposes caused the cumulative loss of 94 percent of the Delta's tidal marshes (Monroe and Kelly 1992).

In addition to the degradation and loss of estuarine habitat, downstream migrant juvenile salmonids in the Delta have been subject to adverse conditions created by water export operations of the CVP/SWP. Specifically, juvenile salmon have been adversely affected by: (1) water diversion from the mainstem Sacramento River into the Central Delta via the manmade Delta Cross Channel, Georgiana Slough, and Three-mile Slough; (2) upstream or reverse flows of water in the lower San Joaquin River and southern Delta waterways; and (3) entrainment at the CVP/SWP export facilities and associated problems at Clifton Court Forebay. In addition, salmonids are exposed to increased water temperatures from late spring through early fall in the lower Sacramento River and San Joaquin River reaches and the Delta. These temperature increases are primarily caused by the loss of riparian shading, and by thermal inputs from municipal, industrial, and agricultural discharges.

Recent habitat restoration initiatives sponsored and funded primarily by the CALFED Program have resulted in plans to restore ecological function to over several thousands acres of habitat within the Delta. During the past three years, approximately 1,500 acres of land have been purchased for restoration activities. Restoration of these areas primarily involves flooding lands previously used for agriculture, thereby creating additional rearing habitat for juvenile salmonids.

V. ASSESSMENT OF IMPACTS

General Impacts

The proposed fishery sampling program has been designed to recapture coded-wire tag marked fall-run chinook salmon smolts released at various locations within the lower San Joaquin River system. No adult chinook salmon or steelhead are expected to be captured during fishery sampling. However, the potential exists to incidentally capture juvenile winter-run and/or spring-run chinook salmon and steelhead. Some common general impacts to the listed species incidentally captured during the course of the study are: 1) physiological stress and disorientation resulting from capture and handling; 2) physical damage which may reduce survival for captured juveniles, through increased disease susceptibility or severe injury; and, 3) mortality.

Capture and Handling

The skin, scale and slime complex of salmonids functions as protection from disease, lubrication for swimming efficiency, and maintenance of homeostasis and osmotic integrity. Severe damage to this complex may lead to osmotic dysfunction or death. Descaling of juvenile chinook salmon may occur during capture and handling. Observed physiological responses suggest that descaling of juvenile chinook salmon could result in decreased resistance to disease and other stressors

encountered in the field, possibly leading to reduced performance capacity and lowered survival (Gadomski, et. al., 1994).

Estimates of Take

A variety of fish species may be collected during Kodiak trawling in the vicinity of Jersey Point including, but not limited to various races of chinook salmon and steelhead. The primary objective of the VAMP fishery sampling program is the recapture of hatchery-reared, coded-wire tag (CWT) marked, fall-run chinook salmon, released at various locations within the San Joaquin River system. Although the majority of juvenile salmonids collected are anticipated to be fall-run chinook salmon smolts, the incidental collection of winter-run and spring-run chinook salmon and steelhead juveniles is expected. Only CWT-marked fall-run chinook salmon smolts (as evidenced by an adipose fin clip) will be intentionally killed. Unmarked chinook salmon and steelhead will be released alive, after collection and processing, into the lower San Joaquin River.

The estimated take, annually, of chinook salmon (by race) and steelhead during VAMP fisheries sampling are summarized in Table I. Using the annual estimates presented in Table I, an estimate of the total take of chinook salmon (by race) and steelhead over the course of the 12-year VAMP fisheries sampling program is summarized in Table II. No adult chinook salmon (all races) or steelhead are anticipated to be collected as part of the VAMP fisheries sampling program.

The estimates of potential take have been derived using data collected in Kodiak trawls in the lower San Joaquin River near Jersey Point during previous investigations (Hanson, unpublished data). The estimates are based on the average number of each species collected per minute towed each year, and an estimate of the total number of Kodiak trawl tows to be performed as part of the VAMP sampling program each year. The maximum annual sampling effort is anticipated to be 36 20-minute collections per day, over a 47-day sampling period between April 15 and June 1, representing a total annual number of collections of 1,692 Kodiak trawl tows, and 33,840 minutes sampled each year. Assuming that the level of sampling effort remains consistent over the 12-year period of VAMP, the total estimated number of trawl collections used in calculating the total incidental take is 20,304. Based upon results of earlier Kodiak trawl collections conducted in the Sacramento River as part of the Georgiana Slough Acoustic Barrier investigations survival of chinook salmon and steelhead in Kodiak trawls is estimated to be 95% (Hanson, unpublished), hence a 5% mortality factor is used to estimate unintentional lethal take in the calculations presented in Table I and II.

Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon and Central Valley steelhead occurring within the action area will be out migrating smolts. Based on the small number of juvenile winter-run chinook , spring-run chinook and steelhead anticipated to be captured annually during the VAMP fishery sampling program and the amount of unintentional mortality expected to occur annually (77 spring-run chinook, 1 winter-run chinook and 3 steelhead), relative to the anticipated population sizes of these species, the NMFS anticipates that the overall effects will be minor. Therefore, the level of incidental take resulting

Table I. Estimate of Chinook salmon and Steelhead take anticipated annually for the VAMP fishery sampling program.

Species	Fall-run Chinook Salmon	Spring-run Chinook Salmon	Winter-run Chinook Salmon	Late-fall-run Chinook Salmon	Steelhead
Life Stage	Fry and Fingerling	Fingerling and Yearling	Yearling	Fry	Yearling[4]
Size Range(mm)[1]	33 -133	73 - 253	121 - 301	0 - 60	180 - 285
Observe	0	0	0	0	0
Capture and/or Handle[2]	12,335	1,539	7	3	55
Tag, fin clip and/or taking tissue for genetic studies	0	0	0	0	0
Collect for Transport	0	0	0	0	0
Intentional Lethal Take	0	0	0	0	0
Unintentional Lethal Take[3]	618	77	1	1	3
Other Take	0	0	0	0	0

[1]Size class criteria for species identification based on daily length intervals from USFWS Delta sampling and DWR SWP salvage sampling.

[2]Number captured estimated from previous sampling data, expanded for maximum anticipated sampling effort of 33,840 minutes sampling per year (Hanson, personal communication).

[3]Unintentional lethal take estimated based on 5% salmonid sampling mortality observed in previous investigations (Hanson, unpublished data).

[4]Steelhead size range based on actual length distribution observed in previous sampling (Hanson, unpublished data).

Table II. Estimate of Chinook salmon and Steelhead take anticipated over the 12-year period for the VAMP fishery sampling program.

Species	Fall-run Chinook Salmon	Spring-run Chinook Salmon	Winter-run Chinook Salmon	Late-fall-run Chinook Salmon	Steelhead
Life Stage	Fry and Fingerling	Fingerling and Yearling	Yearling	Fry	Yearling[4]
Size Range(mm)[1]	33 -133	73 - 253	121 - 301	0 - 60	180 - 285
Observe	0	0	0	0	0
Capture and/or Handle[2]	148,020	18,468	84	36	660
Tag, fin clip and/or taking tissue for genetic studies	0	0	0	0	0
Collect for Transport	0	0	0	0	0
Intentional Lethal Take	0	0	0	0	0
Unintentional Lethal Take[3]	7,416	924	12	12	36
Other Take	0	0	0	0	0

[1]Size class criteria for species identification based on daily length intervals from USFWS Delta sampling and DWR SWP salvage sampling.

[2]Number captured estimated from previous sampling data, expanded for maximum anticipated sampling effort of 33,840 minutes sampling per year (Hanson, personal communication).

[3]Unintentional lethal take estimated based on 5% salmonid sampling mortality observed in previous investigations (Hanson, unpublished data).

[4]Steelhead size range based on actual length distribution observed in previous sampling efforts (Hanson, unpublished data).

from the VAMP fishery sampling program is not expected to appreciably reduce the likelihood of survival and recovery of Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon and Central Valley steelhead populations. In fact, results of the VAMP fishery sampling program are expected to have an overall beneficial effect on the survival and recovery of Sacramento River winter-run, Central Valley spring-run chinook salmon and Central Valley steelhead populations due to a better understanding of the relationship between juvenile chinook salmon and steelhead survival in response to San Joaquin River flow and CVP/SWP exports.

In addition, the VAMP fishery sampling program is not anticipated to alter the current use of the project area as a salmon and steelhead migration corridor, nor is it expected to diminish the values of habitat for survival and recovery of Sacramento River winter-run, Central Valley spring-run chinook salmon and Central Valley steelhead.

VI. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Non-Federal actions that may affect the action area include State angling regulation changes, voluntary State or private sponsored habitat restoration activities, agricultural practices, increased population growth, dredging activities, and urbanization. State angling regulations are generally moving towards greater restrictions on sport fishing to protect listed fish species. Habitat restoration projects may have short-term negative effects associated with in-water construction work, but these effects are temporary, localized, and the outcome is a benefit to these listed species. Farming activities within or adjacent to the action area may have negative effects on water quality due to runoff laden with agricultural chemicals. Future urban development and dredging operations in the action area may adversely affect water quality, riparian function, and stream productivity. However, future land conservation and habitat restoration activities expected in the action area, such as those planned by the ongoing CALFED process, are anticipated to offset many of these adverse effects.

VII. CONCLUSION

Based on the best available information and analysis in this biological opinion, the proposed VAMP fishery sampling program is not likely to jeopardize the continued existence of endangered Sacramento River winter-run chinook salmon, threatened Central Valley spring-run chinook salmon, or threatened Central Valley steelhead.

Notwithstanding NMFS' conclusion that the VAMP fishery sampling program is not likely to jeopardize the continued existence of endangered Sacramento River winter-run chinook salmon, threatened Central Valley spring-run chinook salmon, and threatened Central Valley steelhead or

destroy of modify their designated critical habitat, NMFS anticipates that some actions associated with the VAMP fishery sampling program may result in incidental take of these species. Therefore, an incidental take statement is included with this Biological Opinion for these actions.

VIII. INCIDENTAL TAKE STATEMENT

Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take of a listed animal species that results from, but is not the purpose of, the carrying out of an otherwise lawful activity.

Section 7(b)(4) of the ESA requires that when a proposed agency action is found to be consistent with section 7(a)(2) of the ESA, and the proposed action may incidentally take individuals of a listed species, NMFS will issue a statement that specifies the impact of any incidental taking of endangered or threatened species. It also states that reasonable and prudent measures, and terms and conditions to implement the measures, be provided that are necessary to minimize such impacts. Under the terms and conditions of section 7(o)(2) and 7(b)(4), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of the Incidental Take Statement.

The measures described below are non-discretionary. They must be implemented by the Bureau so that they become binding conditions of any permit, grant or contract issued to Hanson Environmental, Inc., as appropriate, for the exemption in section 7(o)(2) to apply. The Bureau has a continuing duty to regulate the activity covered in this incidental take statement. If the Bureau (1) fails to assume and implement the terms and conditions of the incidental take statement, and/or (2) fails to require Hanson Environmental, Inc. to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit, grant or contract document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Bureau and Hanson Environmental, Inc., must report the progress of the action and its impact on the species to NMFS as specified in this incidental take statement (50 CFR §402.14(i)(3)).

A. Amount or Extent of Take

Hatchery reared, coded-wire tagged (CWT), marked fall-run chinook salmon are the target species for the VAMP fishery sampling program. However, the proposed sampling gear and season is likely to result in the capture of unmarked salmon and steelhead as well. Therefore, the NMFS anticipates that the VAMP fishery sampling program will result in the incidental take of listed Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon, and Central Valley steelhead. The incidental take is expected to be in the form of death, injury, harassment, harm, capture, and collection. The NMFS is quantifying take incidental to the

VAMP fishery sampling program in terms of the daily size criteria used in fisheries monitoring at the SWP fish salvage facility and the USFWS delta fisheries monitoring program.

Annual VAMP fishery sampling program take, by capture, is anticipated to be 7 yearling size Sacramento River winter-run chinook salmon, 1,539 fingerling and yearling size Central Valley spring-run chinook salmon, and 55 yearling size Central Valley steelhead. Annual lethal take is anticipated to be 1 yearling size Sacramento River winter-run chinook salmon, 77 fingerling and yearling size Central Valley spring-run chinook salmon, and 3 yearling size Central Valley steelhead. No adult Sacramento River winter-run or Central Valley spring-run chinook salmon or steelhead are anticipated to be taken as part of the VAMP fisheries sampling program.

Expanding these estimates over the course of the 12-year VAMP fisheries sampling program results in a estimated total take, by capture, of 84 yearling size Sacramento River winter-run chinook salmon, 18,468 fingerling and yearling size Central Valley spring-run chinook salmon, and 660 yearling size Central Valley steelhead. Total lethal take over the 12-year VAMP sampling period is anticipated to be 12 yearling size Sacramento River winter-run chinook salmon, 924 fingerling and yearling size Central Valley spring-run chinook salmon, and 36 yearling size Central Valley steelhead. No adult Sacramento River winter-run or Central Valley spring-run chinook salmon or steelhead are anticipated to be taken as part of the VAMP fisheries sampling program.

B. Effect of the Take

The effect of this action will consist of fish behavior modification, temporary disorientation, and potential death or injury to juvenile Sacramento River winter-run chinook salmon, Central Valley spring-run chinook salmon and Central Valley steelhead due to the capture and handling of fish during the sampling activities.

In the accompanying biological opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to the listed species.

C. Reasonable and Prudent Measures

The NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize the incidental take of listed species caused by the proposed VAMP fishery sampling program.

1. Measures shall be taken to minimize exposure and reduce physiological stress and mortality associated with collection, handling, and processing of unmarked chinook salmon and steelhead.

2. Measures shall be taken to monitor and report the incidental take of listed species.

D. Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the ESA, the Bureau is responsible for Hansen Environmental, Inc., compliance with the following terms and conditions that implement the reasonable and prudent measures described above:

1. **Measures shall be taken to minimize exposure and reduce physiological stress and mortality associated with collection, handling, and processing unmarked chinook salmon and steelhead**

Terms and conditions:

a) At least one trained and qualified fisheries technician (minimum of 2 years experience with sampling and handling of juvenile anadromous salmonids) shall be onsite during each day of VAMP fisheries sampling to insure full adherence to sampling and handling protocols described in section II of this opinion.

b) Results of each individual Kodiak trawl collection will be monitored by the field crew leader and all fish collected will be transferred immediately from the trawl to buckets filled with local river water, where the fish will be held during processing.

c) All unmarked chinook salmon and steelhead shall be removed, processed first, and returned to the water at a location downstream of the sampling site as soon as possible immediately after enumeration and measurement. No fish will be transported more than 1/4 mile from the sampling site. Field personnel shall visually monitor and record the condition of these fish (e.g. healthy and vigorous, lethargic, loss of equilibrium, etc) immediately before release.

d) Incidental take of Sacramento River winter-run chinook salmon for VAMP fishery sampling shall be based on daily size class criteria for species identification used in fisheries monitoring at the SWP fish salvage facilities and the USFWS Delta fisheries monitoring program. Annual incidental take, by capture, shall not exceed 7 juvenile winter-run chinook salmon. Intentional lethal take of Sacramento River winter-run chinook salmon is not allowed and unintentional lethal take may not exceed 1 juvenile winter-run chinook salmon, annually. If cumulative take of Sacramento River winter-run chinook salmon during any VAMP sampling year reaches any of the levels identified above, the Bureau and Hansen Environmental, Inc., must reinitiate consultation.

e) Incidental take of Central Valley spring-run chinook salmon for VAMP fishery sampling shall be based on daily size class criteria for species identification used in fisheries monitoring at the SWP fish salvage facilities and the USFWS Delta fisheries monitoring program. Annual incidental take, by capture, shall not exceed 1,539 juvenile spring-run chinook salmon, annually. Intentional lethal take of Central Valley spring-run chinook salmon is not allowed and unintentional lethal take may not exceed 77 juvenile spring-run chinook salmon. If cumulative take of Central Valley spring-run chinook salmon during any

VAMP sampling year reaches any of the levels identified above, the Bureau and Hansen Environmental, Inc., must reinitiate consultation.

f) Incidental take of steelhead through capture and handling may not exceed 55 juveniles annually during the VAMP fishery sampling period. Intentional lethal take of steelhead is not allowed and unintentional lethal take of steelhead may not exceed 3 juvenile steelhead, annually. If cumulative take of steelhead during any VAMP sampling year reaches any of the levels identified above, the Bureau and Hansen Environmental, Inc., must take actions to avoid further loss and reinitiate consultation.

g) In the event that the number of Sacramento River winter-run or Central Valley spring-run chinook salmon and/or Central Valley steelhead collected begins to increase within a daily sampling period, or the cumulative take approaches the limits described in d), e), or f) above, sampling will be modified to reduce the duration of Kodiak trawl collections from 20 minutes to 10 minutes. In addition, efforts will be made to reduce the time required for sample processing and returning unmarked chinook salmon and/or steelhead to the lower San Joaquin River within the shortest period of time practicable.

2. **Measures shall be taken to monitor and report the incidental take of listed species.**

Terms and conditions:

a) Any incidental mortalities of unmarked juvenile chinook salmon and/or steelhead shall be reported within two (2) working days to the NMFS, Sacramento Field Office (Fax no. (916)930-3629). All juvenile unmarked chinook salmon and steelhead mortalities must be retained, placed in whirl-pak or zip-lock bags, labeled with the date and time of collection, fork length, capture method (gear), location of capture, and frozen as soon as possible. Frozen samples must be retained until specific instructions are provided by the NMFS.

b) A report summarizing the collection of chinook salmon and steelhead shall be submitted by July 15th following each annual sampling period. The report shall include:

(1) a detailed description of activities conducted during the sampling period including the total number of Kodiak trawls, the length of each trawl, the dates and location, number of unmarked chinook salmon and steelhead captured and released, and number of unmarked chinook salmon and steelhead killed;

(2) specific data for chinook salmon and steelhead shall include, but not be limited to, the number of juvenile chinook (marked and unmarked) taken, the fork length of each individual chinook salmon, race identification of individual salmon by size, time of collection, condition of unmarked salmon and steelhead when captured, and location and condition of unmarked salmon and steelhead when released;

(3) measures taken to minimize disturbances to listed species and the effectiveness of these measures, the condition of listed species taken, the disposition of listed species in the event of mortality, and a brief narrative of the circumstances surrounding injuries or mortalities; and,

(4) a description of any problems which may have arisen during sampling activities and a statement as to whether or not these had any unforeseen effects; and

c). An annual report shall be submitted by November 30th of each year during the 12-year VAMP fishery sampling period, summarizing the results of the study to date, the success of the study relative to its goals, the annual and cumulative take of unmarked chinook salmon and steelhead, and a detailed description of planned sampling methods and expected sampling period and activities for the following year. At the completion of the VAMP fishery sampling program a final report detailing study methods and results will be provided by November 30th.

All required reports shall be submitted to:

Regional Administrator
National Marine Fisheries Service
Southwest Regional Headquarters
501 West Ocean Blvd., Suite 4200
Long Beach, California 90802-4213

and;

Supervisor, Sacramento Area Office
National Marine Fisheries Service
Protected Resources Division
650 Capitol Mall, Suite 8-300
Sacramento, California 95814-4706

IX. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. These "conservation recommendations" include discretionary measures that the Bureau can take to minimize or avoid adverse effects of a proposed action on a listed species or critical habitat or regarding the development of information. In addition to the terms and conditions of the Incidental Take Statement, the NMFS provides the following conservation recommendations that would reduce or avoid adverse impacts on listed species:

1. The Bureau should support expanded anadromous salmonid monitoring programs throughout the Sacramento-San Joaquin Delta to improve our understanding of the life history of listed species and improve the ability to provide fisheries protection through real-time management of CVP facilities.

2. The Bureau should support and promote aquatic and riparian habitat restoration within the Sacramento-San Joaquin Delta with special emphasis upon the protection and restoration of shaded riverine aquatic habitat.

X. REINITIATION OF CONSULTATION

This concludes formal consultation on the actions outlined in the biological opinion for the proposed VAMP fishery sampling program from April 15, 2000 through June 1, 2011. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

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